

REMARKS

This case as filed contained claims 1-31. Claims 1-4, 11, 12, 15 and 19-31 have been rejected. Claims 5-10, 13, 14 and 16-18 are objected to as being dependent upon a rejected base claim. Claim 24 has been cancelled without prejudice or disclaimer. Claims 1, 2, 5, 6, 8-10, 15, 17, 18, 26, and 29 have been amended and new claims 32-46 have been added. This case now contains claims 1-23 and 25-46 are now in this case.

Amendments to the Specification

A number of clerical errors in the specification pointed out by the Examiner have been amended. The status of one of the priority documents has been updated. None of the amendments represents the addition of new matter.

Amendment of the Claims

Claims 2, 6 and 15 have been rewritten in independent form. Claims 1, 2, 6, 15 and new claim 46 are independent claims to non-porous membranes. Claims 3, 4, 11-14, 19-23, 25-32 depend from claim 1. Claims 10 and 33-40 depend from claim 2. Claims 5, and 7-9 depend from claim 6. Claims 16-18 and 41-45 depend from claim 15.

Claim 1 has been amended to recite that the membrane comprises a hydrogen-permeable central layer in addition to at least one catalyst, at least one protective layer, and at least one barrier layer. This amendment requires the presence of components that were optional in the recitation of claim 1 as filed.

Claims 5, 8 and 9 have been made dependent upon claim 6.

Claim 10 has been made dependent upon claim 2.

Claims 17 and 18 have been made dependent upon claim 15.

Claim 24 has been canceled without prejudice as redundant over claims to non-porous membranes.

Claims 26 and 29 have been amended to recite "one or more membranes" and to remove reference to "any of claims."

Claim 31 has been amended to correct a minor typographic error the word "a" has been added.

New claims 32 to 46 have been added. New claim 32 is supported in the specification at page 25, lines 9-11 where a list of alloys including V/Ni is given. New claims 33 and 34 are supported by original claims 4 and 3 respectively. New claim 35 is supported in the specification at page 12, lines 25-26. New claim 36 is supported by original claim 12. New claims 37-40 are supported by original claims 25-28, respectively. New claims 41 and 42 are supported by original claims 4 and 3, respectively. New claim 43 is supported in the specification at page 25, lines 9-11. New claims 44 and 45 are supported by original claims 25 and 26, respectively. New claim 46 is supported in the specification at page 20, line 3 where it is indicated that the at least one catalyst layer is porous, non-continuous or both.

None of the amendments represents the addition of new matter and all of the amendments are supported in the specification.

The Rejections

Claims 24 and 26-28 are rejected under 35 U.S.C. 112, second paragraph as being indefinite. The Examiner points out that the use of "any of claims" when the claims depend only from claim 1 is incorrect. Claim 24 has been cancelled. Claims 26 and 29 have been amended to replace the language objected to. The amendments obviate the rejection.

Claims 1-4, 11, 12, 15 and 19-31 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by the composite hydrogen separation membrane and its use in Edlund (5,259,870). The Office Action points to "Examples 1-4 and 9 and the corresponding portion of the specification." Claim 1 has been amended which is believed to obviate the rejection of claims 1, 3-4, 11, 12, 19-23, 25-31. Claim 24 has been canceled. Applicants respectfully traverse this rejection with respect to claims 2 and 15 which have been rewritten in independent form and with respect to claim 10 which now depends from claim 2.

Edlund, 5,259,870, relates to composite metal membranes having an "intermetallic diffusion barrier separating a hydrogen-permeable base metal and a hydrogen-permeable coating metal." (See Abstract, emphasis added).

The base metal "is selected from hydrogen-permeable transition metals from Groups IIIB, IVB, VB, VIIIB and VIIIB of the Periodic Table and alloys containing ≥ 20 wt% of said metals, and maybe from 25 to 250 microns in thickness." (See, col. 2, lines 30-34).

The coating metal "is a hydrogen-permeable transition metal. . . preferably selected from the transition metals of Groups VIIIB and VIIIB of the Periodic Table, most preferably Fe, Mn, Ni, Pd, Pt, Ru and alloys containing ≥ 20 wt% of said metals and preferably from 0.01 to 1.0 microns in thickness." (See, col. 2, lines 35-41).

The intermetallic diffusion barrier "is preferably selected from the group consisting essentially of oxides of aluminum, lanthanum, molybdenum, silicon, tungsten and yttrium and sulfides of molybdenum, tungsten and vanadium and maybe from 0.1 to 25 microns in thickness." The diffusion barrier "is applied as a continuous layer between the coating metal and the base metal." (See col. 2, lines 42-55).

Examples 1, 2 and 4 of Edlund relate to a Ni/SiO₂/V, a NiCu (alloy)/SiO₂/V and a Pd/SiO₂/V composite membrane, respectively. Example 3 relates to a Ni/V-sulfide/V

composite membrane. In each case, the membrane is formed employing layers of metallic foil.

Claim 2 has been written in independent form. Claim 2 as filed recites that the hydrogen-permeable membrane layer of the membrane is a cermet. Edlund does not teach or suggest a membrane containing a cermet. This rejection should be withdrawn with respect to claims 2.

Claim 15 has been written in independent form. Claim 15 recites that the membrane has a protective layer which is a porous metal oxide in addition to the hydrogen-permeable central layer and catalyst layer. As stated in the specification on pages 20-21, the protective layers are porous ceramic layers that protect the inner layers of the membrane from detrimental feedstream contamination. As illustrated in Fig. 1, the protective layers are the outermost layers of the membrane.

Edlund does not teach or suggest a membrane having such a protective layer. Edlund does not teach all of the components of the membrane of claim 15. This rejection should be withdrawn with respect to claim 15.

Claim 1 has been amended to recite that the membrane comprises a hydrogen-permeable central layer, a catalyst layer, at least one protective layer and at least one barrier layer. As defined in the specification on pages 20 and 21, the barrier layers minimize or prevent detrimental interdiffusion of metals between the catalyst layer and the central hydrogen-permeable layer. The protective layers are on the outer surfaces of the membrane. Edlund does not teach or suggest a membrane having protective layers as defined in the specification. More specifically, Edlund does not teach or suggest a membrane having four layers including a protective layer, a catalyst layer, a barrier layer, and a hydrogen-permeable central layer. Claim 1 as amended should be considered patentable over Edlund. Claims 3, 4, 11, 12, 19-31 all depend from claim 1. This rejection should be withdrawn with respect to all of these claims in view of the amendment of claim 1.

In view of the amendments and the foregoing arguments, this rejection should be withdrawn.

The New claims

New claim 32 depends from amended claim 1, and is believed to be allowable. New Claims 33-40 depend from claim 2 which is believed to be allowable. New claims 41-45 depend from claim 15 which is believed to be allowable.

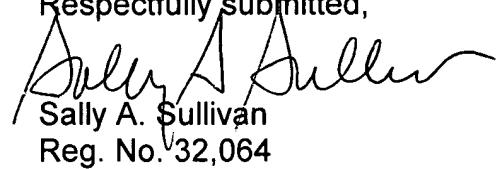
Claim 46 recites a membrane in which the catalyst layer is "porous, non-continuous, or both." The catalyst layer may be a metal, an alloy, a ceramic or a cermet. Edlund does not teach or suggest a membrane with a porous or non-continuous metal layer. Edlund teaches only membranes having continuous metal layers separated by a diffusion barrier. Claim 46 should be considered patentable over Edlund.

Claims 5-10, 13, 14 and 16-18 are objected to as being dependent upon a rejected base claim. Claim 6 has been rewritten in independent form. Claims 5 and 7-9 depend from claim 6. Claim 10 has been amended to depend from claim 2 which is believed to be allowable. Claims 16-18 have been amended to depend from claim 15 which is believed to be allowable. Claims 13 and 14 depend from amended claim 1 which is believed to be allowable. The amendments are believed to obviate this objection.

Conclusion

The claims remaining in this case are believed to be allowable and passage to issuance is respectfully requested. This case as amended contains four independent claims and a total of 45 claims. Excess claims fees for 2 independent claims (\$200) and 14 additional dependent claims (\$350) are believed to be due. This response is accompanied by a Petition for Extension of Time of two months and fee of \$225. A check in the amount of \$775 is enclosed. If the fees submitted are incorrect, please charge any deficiency or credit any overpayment to deposit account 07-1969.

Respectfully submitted,



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